Phosphatase-mediated bioprecipitation of lead by soil fungi

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Table 1. Tolerance indices (TI), pH values, P_i release and Pb-removal from MCD liquid media after growth of *Aspergillus niger* and *Paecilomyces javanicus*.

	TI (%)		pH				P_i (mM)				Pb concentration in supernatant (mM)		Pb removed by fungal biomass (µmol ml^{-1})		Pb removed from solution (%)	
MCD+	G2P+Pb	PyA+Pb	G2P	PyA	G2P+Pb	PyA+Pb	G2P	PyA	G2P+Pb	PyA+Pb	G2P+Pb	PyA+Pb	G2P+Pb	PyA+Pb	G2P+Pb	PyA+Pb
Abiotic control	NA	NA	6.0 ± 0.0	6.0 ± 0.0	6.0 ± 0.0	6.0 ± 0.0	ND	ND	ND	ND	4.98 ± 0.02	4.94 ± 0.04	NA	NA	NA	NA
A. niger 10d	67.7 ± 0.6 %	56.3 ± 0.2 %	3.3 ± 0.2	3.9 ± 0.0	4.6 ± 0.1	3.7 ± 0.1	14.1 ± 0.6	5.9 ± 0.5	9.0 ± 0.5	9.9 ± 0.3	1.35 ± 0.18	1.38 ± 0.02	3.52 ± 0.13	3.58 ± 0.02	70.7	72.5
A. niger 20d	58.8 ± 0.7 %	78.0 ± 1.8 %	3.6 ± 0.0	3.5 ± 0.1	3.3 ± 0.3	3.4 ± 0.0	18.0 ± 1.7	6.1 ± 0.4	19.3 ± 0.8	15.4 ± 0.4	0.68 ± 0.02	0.44 ± 0.02	4.31 ± 0.13	4.56 ± 0.03	86.5	92.3
A. niger 30d	54.7 ± 0.6 %	108.1 ± 1.1 %	3.7 ± 0.1	3.5 ± 0.2	3.1 ± 0.0	3.3 ± 0.4	24.2 ± 0.8	7.6 ± 1.4	24.7 ± 0.8	26.0 ± 0.8	0.007 ± 0.02	0.005 ± 0.002	4.94 ± 0.04	4.92 ± 0.01	99.8	99.5
P. javanicus 10d	97.4 ± 0.2 %	59.1 ± 0.3 %	7.6 ± 0.1	6.1 ± 0.2	6.3 ± 0.1	5.9 ± 0.0	7.2 ± 0.5	6.1 ± 0.7	15.7 ± 1.7	13.8 ± 1.2	2.22 ± 0.03	1.47 ± 0.09	2.68 ± 0.15	3.52 ± 0.09	53.8	71.3
P. javanicus 20d	89.6 ± 0.3 %	144.8 ± 2.4 %	6.5 ± 0.3	6.3 ± 0.1	6.5 ± 0.2	6.2 ± 0.2	11.5 ± 0.8	8.4 ± 1.2	21.6 ± 1.9	15.5 ± 1.5	0.14 ± 0.28	1.31 ± 0.04	4.84 ± 0.18	3.66 ± 0.03	97.2	74.1
P. javanicus 30d	122.8 ± 0.5 %	177.6 ± 0.1 %	6.9 ± 0.1	6.6 ± 0.3	6.8 ± 0.4	6.6 ± 0.5	15.0 ± 0.4	9.5 ± 0.5	25.7 ± 0.7	25.9 ± 1.0	0.028 ± 0.03	0.03 ± 0.02	4.97 ± 0.01	4.91 ± 0.02	99.8	99.4

Tolerance indices (TI) were derived from the biomass dry weight ratios of lead-exposed mycelium to control mycelium harvested at 10, 20 and 30 d (Sayer *et al*., 1995; Wei *et al*., 2013). The pH values, and P_i and Pb concentrations are those obtained from analysis of culture supernatants after removal of biomass. Pb removed by the biomass is expressed as µmol ml^{-1} culture medium for ease of comparison with supernatant Pb concentrations: values can be multiplied by 100 to give total µmol Pb removed. *A. niger* and *P. javanicus* were grown in MCD liquid media without Pb, or amended with 5 mM $Pb(NO_3)_2$, and containing 30 mM $C_3H_7Na_2O_6P \cdot xH_2O$ (G2P) or 5 mM $C_6H_{18}O_{24}P_6 \cdot xNa^+ \cdot yH_2O$ (PyA) as sole source of P. Organisms were grown at 25°C in the dark on an orbital shaking incubator at 125 rpm. Values shown are means of at least three measurements with typical relative standard deviations of about 5%. NA = not applicable; ND = not detectable.